Calhoun
Institutional Archive of the Naval Postgraduate School

Calhoun: The NPS Institutional Archive

DSpace Repository

Theses and Dissertations 1. Thesis and Dissertation Collection, all items

1985-06

An analysis of the Navy Conventional Gun Ammunition Inventory Management System

Covert, Harold Duane

http://hdl.handle.net/10945/21151

This publication is a work of the U.S. Government as defined in Title 17, United States Code, Section 101. Copyright protection is not available for this work in the United States.

Downloaded from NPS Archive: Calhoun

DUDLEY KNOX LIBRARY

Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943

http://www.nps.edu/library

DUDLEY KNOX LIBRARY
NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA 93943

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

AN ANALYSIS OF THE NAVY CONVENTIONAL GUN AMMUNITION INVENTORY MANAGEMENT SYSTEM

by

Harold Duane Covert

June 1985

Thesis Advisor: Alan W. McMasters

Approved for public release; distribution unlimited.

T224133

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) An Analysis of the Navy Conventional Gun Ammunition Inventory Management System		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis June, 1985
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Harold Duane Covert		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943-5100		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943-5100		12. REPORT DATE June, 1985
		13. NUMBER OF PAGES 69
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Ammunition
Inventory Management
Stock Points
CAIMS

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Management of the Navy's Conventional Gun Ammunition System involves a logical progression of decisions regarding procurement, distribution, warehousing, maintenance, and consumption or disposal. The logistical problems associated with this management are complicated by the fact that this ordnance has a limited shelf life and, primarily for physical security reasons, requires detailed end item visibility throughout its life cycle. This research reviews the ammunition management organization as

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

it is designed to operate, then examines the actual operation of this system, highlighting problem areas that inhibit efficiency. Finally, improvements are suggested that should result in cost savings to the Navy.

Approved for public release; distribution is unlimited.

An Analysis of the Navy Conventional Gun Ammunition Inventory Management System

by

Harold Duane Covert
Lieutenant Commander, United States Navy
B.A., University of Kansas, 1973

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1985

ABSTRACT

Management of the Navy's Conventional Gun Ammunition System involves a logical progression of decisions regarding procurement, distribution, warehousing, maintenance, and consumption or disposal. The logistical problems associated with this management are complicated by the fact that this ordnance has a limited shelf life and, primarily for physical security reasons, requires detailed end item visibility throughout its life cycle. This research reviews the ammunition management organization as it is designed to operate, then examines the actual operation of this system, highlighting problem areas that inhibit efficiency. Finally, improvements are suggested that should result in cost savings to the Navy.

TABLE OF CONTENTS

I. INTRODUCTION 9

A. THE RESEARCH PROBLEM 9

B. SCOPE 9

C. PREVIEW 10

II. MANAGEMENT OF CONVENTIONAL GUN AMMUNITION 12

A. AMMUNITION AS A COMMODITY 12

B. THE AMMUNITION MANAGEMENT ORGANIZATION 13

1. Chief of Naval Operations 14

2. Naval Sea Systems Command 15

3. Fleet Commanders-in-Chief 15

4. Naval Ammunition Production Engineering Center 16

5. Ships Parts Control Center 16

6. Naval Weapons Stations 17

C. REQUIREMENTS DETERMINATION 17

D. AMMUNITION ACQUISITION 20

E. ASSET MANAGEMENT 22

1. General Strategy 22

2. Shelf Life Considerations 23

3. Renovation Planning 24

4. Disposal Planning 27

5. Management Procedures 28

III. ANALYSIS OF GUN AMMUNITION MANAGEMENT 35

A. RESEARCH METHODOLOGY 35

B. AN ILLUSTRATIVE EXAMPLE 35

C. PRODUCER RESOURCE MANAGEMENT 37

1. The Naval Sea Systems Command 38

2. Ships Parts Control Center 40
3. Naval Weapons Stations 44
4. System Problems 49
D. USER RESOURCE MANAGEMENT 52
1. Fleet Commanders-in-Chief 53
2. Fleet Units 54

IV. SUMMARY AND RECOMMENDATIONS 56
A. SUMMARY 56
B. RECOMMENDATIONS 56
1. Naval Sea Systems Command (NAVSEA) 57
2. Ships Parts Control Center (SPCC) 57
3. Naval Weapons Stations 58
4. Consumers 59
5. Areas for Further Research 61

APPENDIX A: AMMUNITION CONDITION CODES 62

APPENDIX B: NAVAL ORDNANCE MANAGEMENT INFORMATION SYSTEM EXAMPLE 64

LIST OF REFERENCES 67

INITIAL DISTRIBUTION LIST 69

LIST OF TABLES

I Overhaul Cycles 24

II Propelling Charge Consumption 39

III ABSLA Achievement 45

IV Ammunition Shipping Costs 50

V Condition Code Analysis 53

LIST OF FIGURES

2.1 Ammunition Management Organization 14
2.2 Material Planning Study 19
2.3 JCAP Coordinating Committees 22
2.4 Renovation Budget Model 26
2.5 CAIMS Capabilities 30
3.1 CAIMS Reporters and Users 43

I. INTRODUCTION

A. THE RESEARCH PROBLEM

The Naval Sea Systems Command (NAVSEA) is charged with the management of the Navy's conventional gun ammunition throughout its logistics life cycle. NAVSEA assists in determining requirements, directs contracts for production, performs maintenance, provides retail storage facilities, and maintains asset posture information for this ordnance. Involved in this process are the typical logistics functions regarding transportation, warehousing, and maintenance of economical inventory stocks at numerous locations worldwide.

Of particular interest is the fact that this ammunition requires periodic inspection, certification, and maintenance. In other words, ammunition has a shelf life beyond which it may become unstable and unsuitable for use. With this factor in mind, it is essential that NAVSEA activities properly rotate stock, issuing oldest material first to customers, in order to avoid unnecessary maintenance costs.

NAVSEA managers, aware of this basic doctrine, have been frustrated in the past in their attempts to smoothly purge stocks of older materials. As a consequence, this research was commissioned by NAVSEA (SEA-642), Ammunition Management Division, to attempt to identify causes for a breakdown in efficient inventory turnover. Additionally, problems in distribution, maintenance, consumption, and disposal are addressed.

B. SCOPE

NAVSEA has program responsibility for all conventional ammunition with a supply cognizance code of "2T" with the exception of underwater mines. For the purposes of this study, a manageable subset of this ordnance, conventional gun ammunition, is addressed. The term "conventional" refers to non-nuclear ordnance, and gun ammunition refers to that ordnance fired from naval guns which range in diameter from twenty millimeters to sixteen inches.

For conventional gun ammunition, total Navy inventory objectives for any point in time are set by the Chief of Naval Operations as a result of annual requirement reviews. These objectives result from strategic planning sessions, with the majority of the data classified Secret. For the purposes of this research, these objectives are fixed and not subject to review. This being the case, this thesis reviews the ammunition management system and attempts to determine what controls need to be strengthened or established to enable managers to provide customer support in an efficient manner.

NAVSEA program managers sponsoring this research requested an overall review of the system to highlight potential problem areas, with follow-on research to be conducted in specific areas of concern.

C. PREVIEW

Chapter II addresses the ammunition management organization as it is currently structured. Information on how the system is designed to operate was obtained from visits with key management personnel at the Naval Sea Systems Command (NAVSEA), the Naval Supply Systems Command (NAVSUP), the Ships Parts Control Center (SPCC), the Naval Ammunition Production Engineering Center (NAPEC), and at Naval Weapons Stations. In addition, telephone interviews were also conducted with these and other managers in the system. Concurrently, a thorough review of applicable instructions regarding conventional ammunition management was made. All of this information is summarized in Chapter II.

Chapter III discusses the actual interface among the various components of the organization. Information on how it actually operates was obtained from personal observations which were made during field trips to the activities listed above and from the interviews. Representative data indicating expenditures, assets on hand, and historical consumption was retrieved from the Conventional Ammunition Integrated Management System (CAIMS) and from weapons station Naval Ordnance Management Information System (NOMIS) reports. Supplementing this was the author's recent experiences in ordnance management from a fleet perspective, primarily from a user's viewpoint.

In Chapter IV, a summary of findings and conclusions is presented. Additional areas for further study are recommended for specific problems highlighted by this research but beyond the scope of this thesis.

II. MANAGEMENT OF CONVENTIONAL GUN AMMUNITION

A. AMMUNITION AS A COMMODITY

Peculiarities associated with ammunition separate it from other commodities managed by the Department of Defense. The most obvious is the inherent danger associated with the handling of explosives. To assist the logistics community in the storage, shipment, and handling of ammunition, specific items are divided into explosive classes which denote compatibility with other end items based on volatility and hazards of progressive combustion. Each principal end item is also assigned a Net Explosive Weight (NEW) which is used in computing maximum storage limits within a given magazine, again to avoid the possibility of progressive detonations of magazines.

Conventional gun ammunition consists of expendable principal end items not generally supported by spare parts. In this regard, it is commonly referred to as having a "level of effort" orientation in logistics, as opposed to a "mission orientation" item, where stockage levels are based on assessments of specific enemy capabilities. For "level of effort" items, no specific targets are contemplated, but anticipated rates of usage drive the requirements process.

End item visibility is maintained throughout the logistics life cycle. This is centrally managed and accomplished via the Conventional Ammunition Integrated Management System (CAIMS), to be discussed in detail subsequently. CAIMS provides record keeping and asset management information for end items from procurement through consumption or disposal. For gun ammunition, end items are identified by Navy Ammunition Logistics Codes (NALCs) or Department of Defense

Identification Codes (DODICs) and lot numbers, which provide manufacturing location and date. In this manner, CAIMS users can receive virtual real time asset management information showing quantities, age, and location of any ammunition.

Requirements are based on projected numbers and locations of users and expected rate of use. This is the primary factor in setting inventory objectives. However, unlike most expendable commodities, ammunition procurement does not consider past demand as the primary factor driving the problem. Instead, a complex set of wartime, mobilization, and training scenarios is used as the primary method of setting objectives. Expected training requirements, based on historical data, are additionally considered in the final asset objective.

Gun ammunition requires periodic recertification to ensure its continued safety and reliability for use. Based upon the age of the ammunition, as prescribed by [Ref. 1: p. 4], samples from lots reaching recertification age limits are withdrawn from inventory, inspected, and tested. If found to be satisfactory, the particular lot is assigned a subsequent recertification date; if unsatisfactory, the remainder of that lot is suspended from use and returned to retail outlets for further testing, renovation, or disposal.

Finally, gun ammunition entails more stringent physical security requirements in storage than do most commodities. Specific requirements are outlined in [Ref. 2: pp. 2-5] and are not repeated here due to their level of detail.

B. THE AMMUNITION MANAGEMENT ORGANIZATION

A number of organizations are involved in requirements determination, acquisition, and asset management of conventional gun ammunition. While each activity has specific responsibilities, a great deal of coordination is required as indicated by the dotted-line relationships shown in Figure 2.1. An outline of significant responsibilities follows.

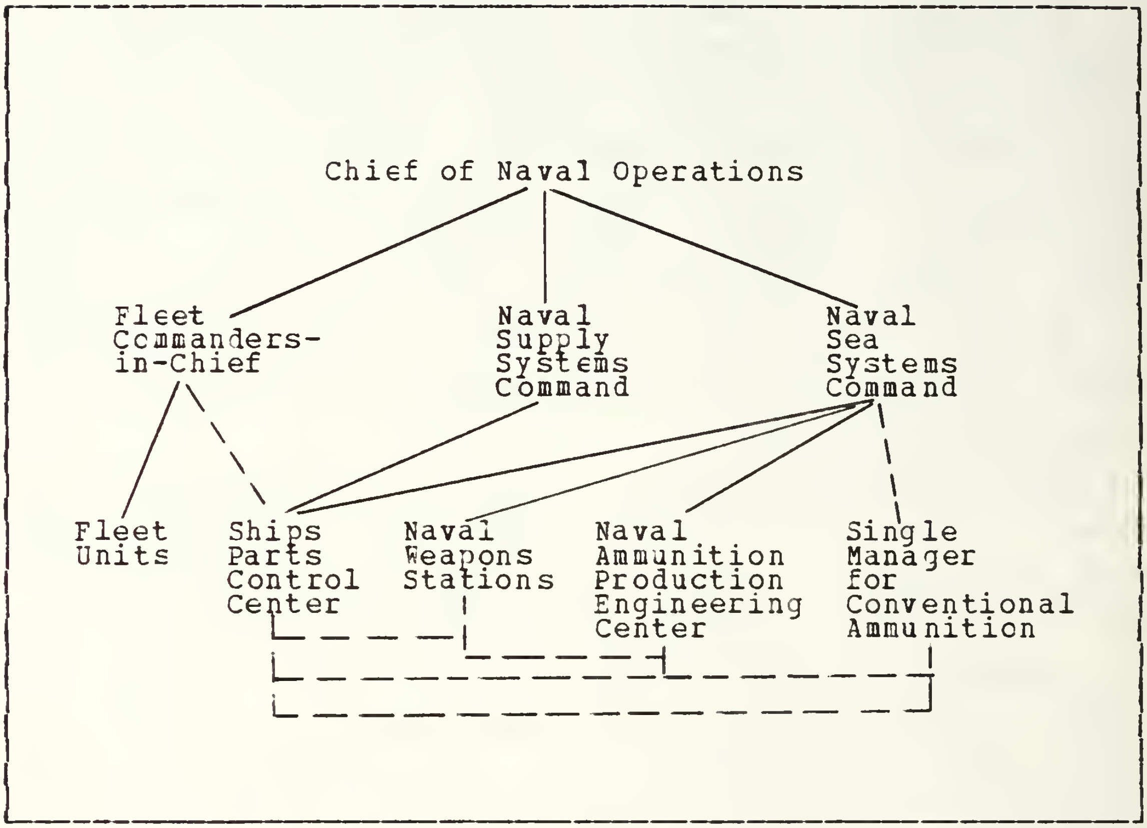

Chief of Naval Operations
Fleet Commanders-in-Chief
Naval Supply Systems Command
Naval Sea Systems Command
Fleet Units
Ships Parts Control Center
Naval Weapons Stations
Naval Ammunition Production Engineering Center
Single Manager for Conventional Ammunition

Figure 2.1 Ammunition Management Organization.

1. Chief of Naval Operations

The Chief of Naval Operations (CNO) has overall responsibility for coordinating the setting of inventory objectives and ensuring that objectives are satisfied. Based on annual Defense Guidance promulgated by the Secretary of Defense, the CNO develops the Non-Nuclear Ordnance Requirements (NNOR), which provides weapons planning for contingency operations worldwide. From recommendations received from Fleet Commanders-in-Chief, the CNO also develops annual Non-Combat Expenditure Requirements (NCER) which states projected assets required for training and testing. Additionally, the CNO publishes War Reserve Material Requirements (WRMR) which are beyond the scope of this study due to security considerations.

2. Naval Sea Systems Command

The Naval Sea Systems Command (NAVSEA) is the designated Program Manager for 2T cognizance conventional ammunition. In this regard, NAVSEA (SEA-64) provides technical direction for procurement, renovation, modification, disposal, and reclamation of this ammunition throughout its logistical life cycle.

NAVSEA translates annual NNOR and NCER statements into specific end item procurement action and renovation programs for budget planning and submittal. Based on asset status, historical consumption rates, renovation and production capabilities, and research requirements, NAVSEA provides detailed trade-off analyses to CNO for use in budget hearings. Once funds have been provided, NAVSEA allocates these Other Procurement Navy (OPN) funds for procurement action and distributes retail stocks to the waterfront outlets.

NAVSEA coordinates all Joint Conventional Ammunition Program (JCAP) actions with the Department of Defense Single Manager for Conventional Ammunition (SMCA), to be discussed subsequently.

3. Fleet Commanders-in-Chief

Based upon historical data and projected schedules, Fleet Commanders-in-Chief (FLTCINCs) annually submit ammunition requirements to the CNO via the Non-Combat Expenditure

Requirements (NCER). As assets become available, FLTCINCs provide inputs for distribution of new procurement and renovated ammunition to NAVSEA which then forwards these inputs to the Ships Parts Control Center (SPCC). As Inventory Manager, SPCC then devises a Fairshare Distribution Plan to actually distribute the material. FLTCINCs also issue management guidance to fleet users regarding utilization of training assets and general management of shipboard ammunition stocks.

4. Naval Ammunition Production Engineering Center

The Naval Ammunition Production Engineering Center (NAPEC) is a field activity under NAVSEA (SEA-64) which provides policy guidance for configuration management, engineering management, and quality assurance of conventional ammunition. NAPEC serves as the In-Service Engineering Agent (ISEA) for these items, providing engineering support for production, maintenance, renovation, and disposal. Additionally, NAPEC serves the key role of providing inventory modeling support for the many NAVSEA requirements in planning, programming, and budgeting. NAPEC engineers are the focal point for all technical matters involving ammunition management and design.

5. Ships Parts Control Center

The Ships Parts Control Center (SPCC), an agency of the Navy Supply Systems Command (NAVSUP), is the supply system manager for conventional ammunition. SPCC, Code 85, is the Inventory Control Point (ICP) and inventory manager for 2T cognizance ammunition (approximately 5,000 line items), providing the following services:

(1) Provides worldwide visibility and management of conventional ammunition via the Conventional Ammunition Integrated Management System (CAIMS);

(2) Receives and processes all ordnance requisitions;

(3) Distributes new production and renovated assets to retail outlets;

(4) Administers the program for the manufacturing, maintenance, modification, and renovation of ammunition through contracting;

(5) Through inputs from NAVSEA and FLTCINCs, issues NAVSEA Ammunition Allowance Lists to all operating forces;

(6) Maintains centralized files on procurement and production status for each end item.

In its role as Inventory Control Point, SPCC manages NAVSEA assets by receiving program guidance and funding from NAVSEA, while following supply system policies promulgated by NAVSUP.

6. Naval Weapons Stations

The Naval Weapons Stations are NAVSEA field activities which serve as retail outlets for the issuance of conventional ammunition. There are six primary stations located in Concord, California; Seal Beach, California; Yorktown, Virginia; Earle, New Jersey; Charleston, South Carolina; and Keyport, Washington. In addition to providing their primary function as retail stock points, the weapons stations also serve important functions in quality control, renovation, and disposal of assets.

C. REQUIREMENTS DETERMINATION

In the ammunition arena, a requirement is "an established need justifying the timely allocation of resources to achieve a capability to accomplish objectives, missions, or tasks" [Ref. 3: p. 19]. The annual requirements process is part of the Planning, Programming, and Budgeting System (PPBS) which essentially begins with the promulgation of

Defense Guidance by the Secretary of Defense. Initial guidance contains broad policy statements indicating peacetime and mobilization plans, acquisition strategy, and fiscal policy.

From this information, the Chief of Naval Operations (CNO) develops the Non-Nuclear Ordnance Requirements (NNOR), which is a specially designed warfare study that outlines quantitative requirements and planning information for major non-nuclear ammunition. This study is prepared by CNO (OP-95) with inputs from Fleet Commanders-in-Chief (FLTCINCs) and is based on planning and strategic concepts to support Defense Guidance. The NNOR is predominately broad in nature, specifying general inventory levels which will support mobilization strategy.

Concurrently, FLTCINCs provide inputs to the CNO regarding their projected needs for training, testing, and firepower demonstrations. These requirements are the Non-Combat Expenditure Requirements (NCER) and reflect best estimates based on past usage and planned schedules. Since the NCER is largely comprised of needs for training afloat and ashore to maintain combat efficiency, test expenditures, and quality evaluation, this is a predictable requirement.

From these documents, the Naval Sea Systems Command (NAVSEA) translates the broad policy issues into specific inventory objectives for each end item. Major considerations in this complex process are:

(1) Assets on hand and historical expenditure data retrieved from the Conventional Ammunition Integrated Management System (CAIMS);

(2) Translation of level of effort objectives or projected combat usage into specific item quantities;

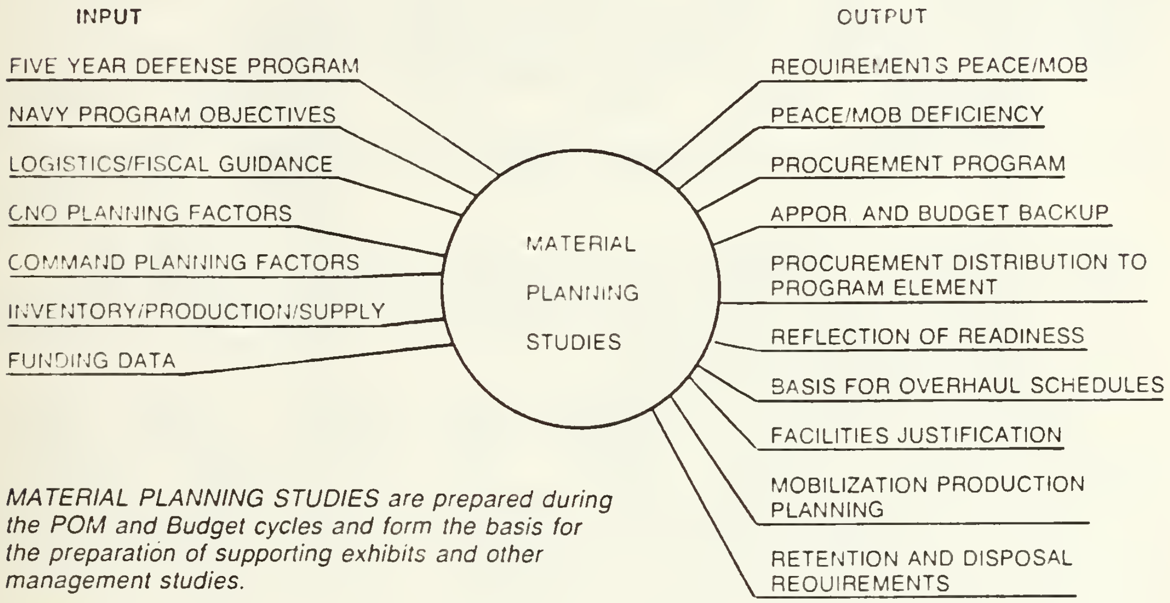
(3) Assets due from previously approved production runs;

(4) Production leadtimes and capabilities;

(5) Renovation capabilities to restore unserviceable ammunition to a serviceable condition;

(6) Substitutability of end items.

In support of this process, Material Planning Studies (MPS) are prepared for each end item. As shown in Figure 2.2, derived from [Ref. 3: p. 21], the MPS is a key study which provides essential management information for decision makers.


INPUT
FIVE YEAR DEFENSE PROGRAM
NAVY PROGRAM OBJECTIVES
LOGISTICS/FISCAL GUIDANCE
CNO PLANNING FACTORS
COMMAND PLANNING FACTORS
INVENTORY/PRODUCTION/SUPPLY
FUNDING DATA
MATERIAL PLANNING STUDIES
OUTPUT
REQUIREMENTS PEACE/MOB
PEACE/MOB DEFICIENCY
PROCUREMENT PROGRAM
APPOR. AND BUDGET BACKUP
PROCUREMENT DISTRIBUTION TO PROGRAM ELEMENT
REFLECTION OF READINESS
BASIS FOR OVERHAUL SCHEDULES
FACILITIES JUSTIFICATION
MOBILIZATION PRODUCTION PLANNING
RETENTION AND DISPOSAL REQUIREMENTS

MATERIAL PLANNING STUDIES are prepared during the POM and Budget cycles and form the basis for the preparation of supporting exhibits and other management studies.

Figure 2.2 Material Planning Study.

NAVSEA consolidates the data provided from CAIMS and the Naval Ammunition Production Engineering Center (NAPEC) computer models and provides the CNO with a tailored plan to meet stated inventory objectives. Incorporated into the plan is a prioritized listing of recommended procurements/renovation and a sensitivity analysis feature which provides recommendations given various fiscal constraints.

As in other elements of the PPBS, the NAVSEA effort not only provides specifics for the budget year in question, but updates the Five Year Defense Plan (FYDP) as well.

D. AMMUNITION ACQUISITION

Once budget action is completed, NAVSEA commences procurement action based on the stated requirements and fiscal constraint. As in other programs, ammunition requirements are seldom met due to fiscal policy. Additional factors often prevent procurement to objective levels [Ref. 3: pp. 21-22], as indicated below:

(1) Inadequate production capabilities exist to meet demand;

(2) Insufficient quantity needed to justify production run;

(3) Deferred objective to a later date to maintain a "warm", or continuously operated, production base for mobilization planning.

Program funds are released from NAVSEA to the Ships Parts Control Center (SPCC) for procurement action. Depending on the production source, SPCC commences the appropriate contract action, normally via the Single Manager for Conventional Ammunition.

In 1977, the Department of Defense issued DoD Directive 5160.65 which designates the Army as the Single Manager for Conventional Ammunition (SMCA). This initiative is intended to achieve economies of scale, prevent duplication of efforts among the services, integrate logistics functions, and generally promote efficiency and effectiveness [Ref. 4: p. 2].

The title of Single Manager can be something of a misnomer, as the primary function of the Army in this instance is to act as a consolidation point for ammunition production. In this regard, the Single Manager acts as a wholesaler, providing the Navy with the desired ammunition and storing it in bulk quantities until distribution to the Navy's retail activities. Insofar as conventional gun ammunition is concerned, the Navy now purchases over ninety percent of all end items from the Army via documents known as Military Interdepartmental Purchase Requests (MIPR's). The key field activity with which the Navy coordinates this program is the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM) located in Rock Island, Illinois. The main vehicle for this coordination is the Joint Conventional Ammunition Program Coordinating Group (JCAP/CG), for which NAVSEA (SEA-642) has primary Navy responsibility. Functional coordination areas are shown in Figure 2.3 from [Ref. 4: pp. 3-8].

The SMCA provides a production base for ammunition via plants which are government-owned and contractor-operated (GOCO) or government-owned and government-operated (GOGO). Provisions are made for peacetime, surge, and mobilization requirements. The SMCA coordinates production for the different services using priorities assigned by JCAP action, providing full contract service through production.

As production is completed, the SMCA also provides storage facilities for wholesale stock. Wholesale inventory includes all conventional ammunition stocks between the point of production and the point of its receipt at the first intermediate retail activity (Naval Weapons Station, tidewater port, or other designated facility). Specifically, conventional gun ammunition is maintained in bulk quantities at the Army Ammunition Activity (AAA) Crane, Indiana; Army Ammunition Plant (AAP) Hawthorne, Nevada; and Army Ammunition Plant (AAP) McAlester, Oklahoma. These huge inland depots, under the command of the Army Armament, Munitions, and Chemical Command (AMCCOM), allow economies of scale which would otherwise be impossible due to the limited

Research, Development, Test, and Evaluation
Industrial Preparedness Planning
Technical Data/Configuration Management
Quality Assurance
Acquisition
Supply
Maintenance
Demilitarization/Disposal
Handling, Transportation, and Traffic Management
Safety
Security
Packaging and Preservation
Requirements
Standard Ammunition Computer Systems
Foreign Military Sales

Figure 2.3 JCAP Coordinating Committees.

magazine capacity available at the retail outlets. Almost half of all Navy gun ammunition is stored in SMCA facilities.

E. ASSET MANAGEMENT

1. General Strategy

As a rule, the positioning of conventional ammunition at coastal stock points shortens the supply pipeline and reduces administrative lead time and transportation costs. Therefore, the Navy's general strategy is to maximize the amount of retail inventory, or those stocks between point of receipt at the intermediate retail activity and point of consumption. Wholesale stocks, maintained by the Single Manager for Conventional Ammunition (SMCA), are largely bulk stocks of commonly used items.

The retail ammunition distribution system operates primarily as a "pull" system in that material requirements are generally requisitioned by the customer weapons stations rather than being "pushed" automatically by the inventory manager, the Ships Parts Control Center (SPCC). Under this system, the individual weapons stations requisition items to meet operating stock levels and projected requirements from customer ships and units.

2. Shelf Life Considerations

Conventional gun ammunition, like many commodities, has a shelf life consideration known as its overhaul cycle. A representative sample of overhaul cycles is shown in Table I, derived from [Ref. 1: p. 4]. Overhaul cycles are continuously in review based on the rate and extent of deterioration of components. As the ammunition reaches its established age, a determination of whether the items are satisfactory for continued service is made based on visual inspection and component testing. Samples are drawn based on proven statistical methods and testing is accomplished by quality control personnel. This process is called recertification. Ammunition which has exceeded its overhaul cycle time limit is not necessarily unserviceable, but it is placed in a suspect category until proper testing can be completed. To avoid unnecessary recertification costs, sound inventory management would dictate that standard policies of stock rotation and first-in, first-out (FIFO) issue should be followed.

To keep track of the serviceability of ammunition, a system of condition codes has been developed. A detailed listing of condition codes is provides as Appendix A, derived from [Ref. 5: pp. 1-2-C1 - 1-2-C5]. Basically, the

TABLE I

Overhaul Cycles

Ammunition Type	Caliber	First Cycle	Second Cycle
All Types	3"/50	-----No Limits-----	
Armor Piercing Projectiles	5"/38, 5"/54	8 years	5 years
High Explosive Projectiles	5"/38, 5"/54	8 years	5 years
Propelling Charges (Electric Prime)	5"/38, 5"/54	-----No Limits-----	

Notes:
(1) First Overhaul Cycle refers to the number of years after assembly.
(2) Second Overhaul Cycle refers to the number of years after last overhaul.
(3) Revision of Overhaul Cycles is now in process, with tentative plans to shorten the intervals between cycles and set a limit of approximately ten years for propelling charges.

codes designate the ammunition as serviceable (usable) or unserviceable (unusable): if serviceable, certain restrictions may be placed in its issue; if unserviceable, the code indicates the reason. Via the Conventional Ammunition Integrated Management System (CAIMS), managers can quickly determine the status of their inventory.

3. Renovation Planning

Renovation is the process by which unserviceable assets are returned to a fully serviceable status, including replacement of components, exterior maintenance, testing, or screening [Ref. 6: p. 2].

Ammunition may be identified as requiring some level of renovation from a variety of sources, including:

(1) Stock Surveillance: a routine, planned testing of ammunition lots conducted on a continuous basis, aimed at providing a general assessment of quality;

(2) Recertification Program: the statistical testing of ammunition which has reached prescribed age limits;

(3) Malfunction Investigation: testing conducted as a result of a malfunction reported by fleet or other user;

(4) Segregation Program: the deliberate setting aside of all ammunition turned in by fleet users, placing this ordnance in condition code K pending inspection and reclassification;

(5) Local Inspection: routine surveillance by weapons handling personnel as a result of daily operations of issue, storage, and receipt;

(6) Modification: reconfiguration of an item in ample supply to one which is in short supply.

Renovation of wholesale stock is normally carried out by the Single Manager for Conventional Ammunition (SMCA), either as a part of standard services (minor maintenance, condition coded E) or at additional cost (major maintenance, condition coded F). Renovation of retail stock is performed at the retail weapons station holding the stock, forwarded to one retail outlet for consolidated renovation, or sent to the SMCA (at extra cost) for renovation if beyond waterfront capabilities.

Since maintenance of assets comprises a significant annual cost and has direct impact on readiness, NAVSEA employs the services of the Naval Ammunition Production Engineering Center (NAPEC) in computer modeling of renovation requirements. As indicated in Figure 2.4, from [Ref. 7: p. 10], a complex series of inputs is used to develop the renovation process.

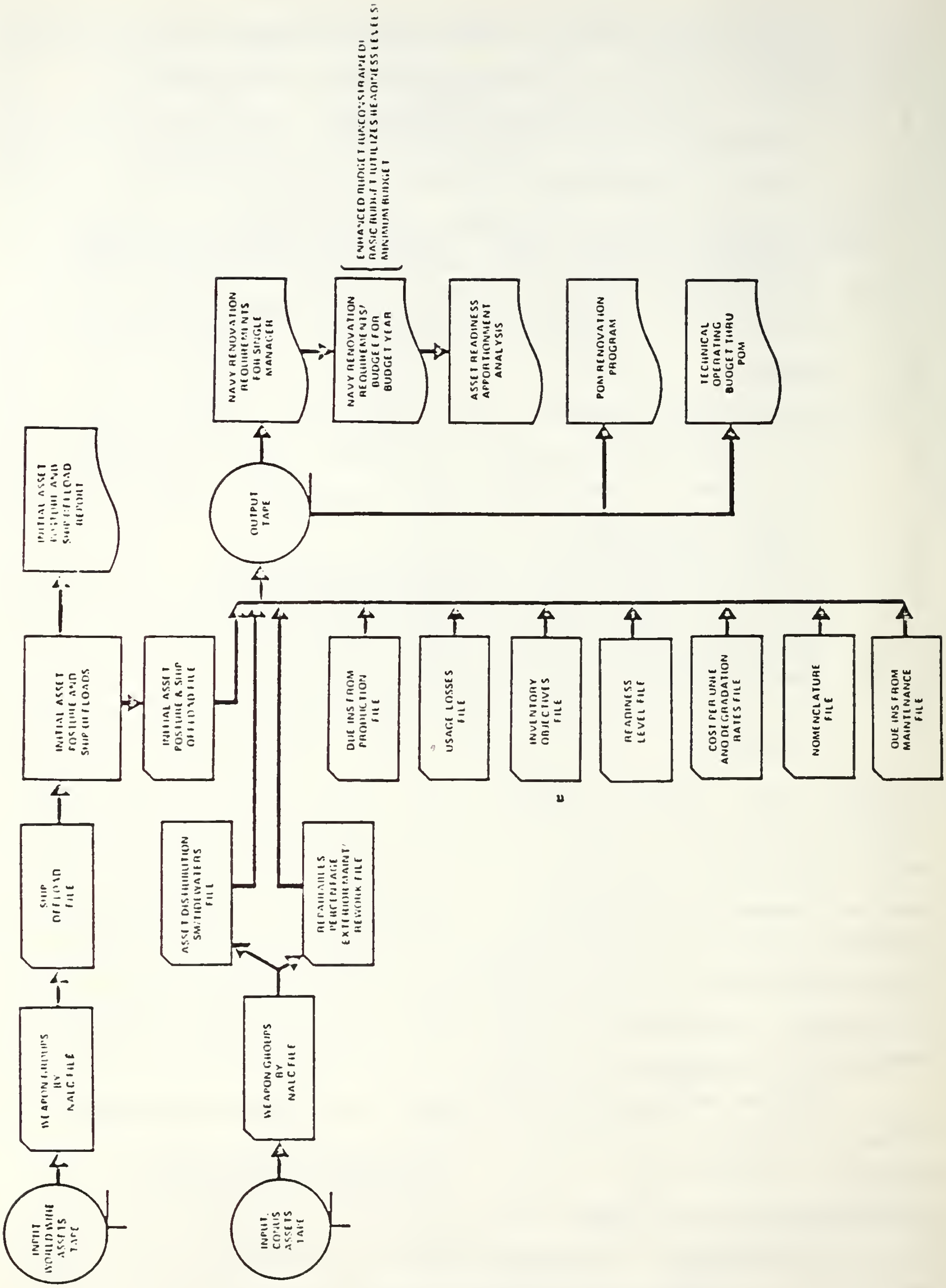

INPUT WORLDWIDE ASSETS TAPE
WEAPON GROUPS BY NALC FILE
SHIP OFFLOAD FILE
INITIAL ASSET POSTURE AND SHIP OFFLOADS
INITIAL ASSET POSTURE AND SHIP OFFLOAD REPORT
INITIAL ASSET POSTURE & SHIP OFFLOAD FILE
INPUT CONUS ASSETS TAPE
WEAPON GROUPS BY NALC FILE
ASSET DISTRIBUTION SM/TIDEWATERS FILE
REPAIRABLES PERCENTAGE EXTERIOR MAINT/ REWORK FILE
DUE INS FROM PRODUCTION FILE
USAGE LOSSES FILE
INVENTORY OBJECTIVES FILE
READINESS LEVEL FILE
COST PER UNIT AND DEGRADATION RATES FILE
NOMENCLATURE FILE
DUE INS FROM MAINTENANCE FILE
OUTPUT TAPE
NAVY RENOVATION REQUIREMENTS FOR SINGLE MANAGER
NAVY RENOVATION REQUIREMENTS/ BUDGET FOR BUDGET YEAR
ENHANCED BUDGET (UNCONSTRAINED)
BASIC BUDGET (UTILIZES READINESS LEVELS)
MINIMUM BUDGET
ASSET READINESS APPORTIONMENT ANALYSIS
POM RENOVATION PROGRAM
TECHNICAL OPERATING BUDGET THRU POM

Figure 2.4 Renovation Budget Model.

Once funds have been apportioned, the data is updated periodically and the model generates a prioritized listing of renovation requirements based on end item asset readiness. This results in a Navy Ammunitions Logistics Code (NALC) Renovation Sequence, which is forwarded quarterly to all stock points, specifying the order in which unserviceable assets are to be renovated.

4. Disposal Planning

Disposal of conventional ammunition is required when an item is unserviceable and inappropriate for renovation, or is found to be in excess of projected requirements. Excess material is identified through the process of stratification, or the application of assets to requirements to determine deficiencies, sufficiencies, or excesses [Ref. 8: pp. 1-3]. This is generally accomplished in conjunction with Material Planning Studies (MPS), described earlier.

Disposal, or demilitarization, seeks to reclaim those components from the end item which may be usable in future applications. Additionally, any demilitarization action should be accomplished in economical quantities and meet ecological standards [Ref. 9: pp. 1-5]. Hazards connected with demilitarization, principally danger of pollution or explosive accident, are prime considerations in the design and location of disposal facilities.

NAVSEA, as Program Manager for disposal and demilitarization actions, coordinates this program between the SMCA and Navy retail outlets. Each of the waterfront retail stock points has the capability to perform limited demilitarization operations, generally consisting of steam out plants for intense cleaning of components and furnace systems for melting of materials. Large disposal programs are forwarded to the SMCA for consolidation. In general, demilitarization at the retail outlet holding the inventory is preferred, since shipping and SMCA disposal are extra cost items.

An important consideration for the NAVSEA disposal branch is that inventory awaiting disposal/demilitarization action requires the same logistical visibility, accountability, security, control, and storage as serviceable stock.

5. Management Procedures

Each level of the management organization has detailed responsibilities and resources for the management of conventional gun ammunition. Following is a discussion of the tools and controls employed at the various levels.

a. Naval Sea Systems Command (NAVSEA)

(1) Asset Readiness. NAVSEA (SEA-64), as the Program Manager for conventional ammunition, has overall responsibility for the status and flow of assets. The Chief of Naval Operations (CNO) annually assigns specific Asset Readiness Objectives (ARO) to NAVSEA, which compares the ratios of serviceable ammunition to total assets for various end items. This ratio, normally in the neighborhood of eighty percent, assists NAVSEA in renovation planning. This asset readiness posture is updated as required from inputs from NAPEC models and CAIMS data.

(2) Approved Basic Stock Level of Ammunition (ABSLA). For each retail stock point, NAVSEA provides a tailored ABSLA, which indicates the quantity of non-nuclear ordnance necessary to support all aspects of that activity's mission. These stock levels are not necessarily to be maintained at a constant level (as an absolute allowance list), but represent a baseline level of inventory. The ABSLA provides the retail activity with stock levels by individual Navy Ammunition Logistics Code (NALC),

dividing requirements into prepositioned war material reserve stock (PWMRS), shipfill stock, and Non-Combat Expenditure Assets (NCEA). Included in the ABSLA is the recommended storage plan for the weapons station magazines. At the retail level, inventory managers maintain operating stock levels based upon the ABSLA and their knowledge of current magazine availability, scheduled customer demands, and scheduled fleet returns. Replenishment requests are sent to SPCC whenever these managers determine that more stock is needed. Operating stock levels may fluctuate widely, caused by a projected offload of a single large ammunition ship, for example.

(3) Issue Priority Program. In March 1985, the Chief of Naval Material (CHNAVMAT) introduced the Issue Priority Program as recommended by NAVSEA. This program formally addresses the problems associated with improper stock rotation policies, which create wasteful expenses in handling, maintenance, and quality evaluation, as well as complicating physical security and magazine utilization. The Issue Priority Program requires that inventory managers and retail activities issue older, but still serviceable, ammunition prior to issuing newer "preferred" assets. The new guidance advises that use of substitutes (different NALC but same basic end item) which are older should be encouraged when feasible. A prioritized listing of substitutes is to be published late this year.

b. Ships Parts Control Center (SPCC)

(1) Conventional Ammunition Integrated Management System (CAIMS). CAIMS is an automated data processing, recording, and display system designed in the batch processing mode. The system provides a wide variety of information necessary for inventory management decisions, particularly those needed by SPCC as

inventory manager. Networking with SPCC are CNO, NAVSEA, FLTCINCs, and certain test facilities. Ammunition stock points (wholesale and retail) are not currently on-line, although plans are underway to include them in the network.

End items are identifiable to the production lot number for conventional gun ammunition, and information is available regarding location, condition code, and quantity. Cost, procurement, and budget data is also available. The wide variety of management information capabilities available from CAIMS is shown in Figure 2.5.

Supply transaction processing
Technical data maintenance
Allowance processing
Procurement and production processing
Stratification
Worldwide asset management reports
Fairshare distribution planning
Lot number tracking
Transportation management
Automated budget reports

Figure 2.5 CAIMS Capabilities.

Information is updated on a daily basis via Transaction Item Reports (TIR's) which are automatically encoded and relayed asset change reports submitted by stock points. Holders of ammunition which do not have TIR capability, such as ships, report changes in asset status via naval messages which are entered into the data base by SPCC staff personnel. Since CAIMS "knows" a reporting activity's asset status at any time, any transaction report which does not agree with the CAIMS data base causes an automatic error message requiring reconciliation.

The CAIMS network is particularly important in view of centralized requisitioning procedures instituted in April 1985 by SPCC Mechanicsburg message 271904Z, dated February 1985, directing all ammunition users to requisition all conventional gun ammunition directly from SPCC. This program has the full endorsement of NAVSEA. Previously, fleet units ordered items from their "parent" weapons station; weapons stations, in turn, would requisition items from SPCC as necessary to replenish inventory levels. Now, SPCC receives all requisitions and refers fleet requisitions to the appropriate retail weapons station for action.

(2) Ammunition Allowance Lists. SPCC has the responsibility for publishing Ships Service Ammunition Allowance Lists based upon inputs from the CNO, Fleet Commanders-in-Chief, and NAVSEA. These allowances are designed to fill the ship's magazines with ordnance appropriate to the ship's wartime missions. Each ship then receives this allowance list which indicates quantities of ordnance by NALC. As new designs of ordnance enter the logistics system, these allowance lists are updated automatically to reflect the latest, or preferred, items.

(3) Fairshare Distribution Plan. SPCC distributes new production and renovated ammunition monthly to retail stock points via the Fairshare plan. The primary intent of the plan is to provide each Fleet Commander-in-Chief (FLTCINC) with approximately the same asset readiness in terms of inventory objectives. Monthly, SPCC inventory managers compare asset postures of each FLTCINC to the objectives set forth by the NCER and NNOR.

Then, new production assets at the wholesale level are divided so that each Fleet Commander is equal in terms of percentage of assets on hand when compared to the NCER and NNOR inventory objectives. FLTCINCs then provide periodic guidance to SPCC regarding desired specific stock points for new ordnance based on this monthly report. This plan complements the stock point requisitions received and filled during the month. A physical transfer of the ammunition does not necessarily take place; often, materials may be held at the SMCA inland depot but reserved for a particular weapons station, to be sent when magazine space is available. Ordnance items renovated at one retail activity may also be "pushed" to another activity.

(4) Notice of Ammunition Reclassification System (NARS). SPCC has the responsibility for notifying ammunition holders when a particular ammunition lot number changes condition code as a result of adverse quality control checks or as a result of malfunction investigations. This is accomplished via a NARS message sent to all holders describing the new condition code and disposal/turn-in instructions.

c. Naval Weapons Stations

(1) Naval Ordnance Management Information System. The Naval Ordnance Management Information System (NOMIS) provides individual weapons stations with source data automation capabilities in the management of inventories. Each retail station has an independent system which is not presently networked with CAIMS. The system is designed for automated stock recording and reporting, providing the station with asset information indicating quantities on hand (by NALC and stock number), production lot numbers, overhaul due dates, magazine location, and cost data. Information is also available

indicating quantities due in from requisition action and quantities reserved for scheduled customers. NOMIS also has the capability to indicate reorder point information based upon a manual input made by the inventory manager. This information is not the result of an inventory model, but only serves as a flag to the manager that requisition action is necessary based on that manager's experience in demand for his end items and his knowledge of scheduled requisitions and offloads.

The primary weapons station user is the Ammunition Distribution and Control (AD&C) division, which is responsible for requisitioning ordnance materials and designating materials for issue to customers. An example of a NOMIS report used by this division is included as Appendix B.

Daily issues and receipts are entered into NOMIS which updates its data base and produces an output which is easily convertible to the station's daily Transaction Item Report (TIR) which is made to CAIMS.

NOMIS is being modernized with the introduction of the Ordnance Management System (OMS) which will provide real-time data and a direct on-line interface with CAIMS. OMS is not yet operational at any weapons station, but is expected to be installed by 1990.

(2) Inventory Procedures. The station's space control branch is responsible for the management of station inventory. It is a complicated process considering the range of items required, magazine capacities and locations, and Net Explosive Weight (NEW) restrictions. For conventional gun ammunition, ordnance is stored on pallets which are normally stacked three high and arranged in aisles. The inventory problem is compounded by the fact that some pallets may contain a mixture of types of ammunition (different NALCs).

Inventory counts are conducted annually on selected magazines which are representative of the stock on hand. When possible, all magazines are inventoried, but this is generally too disruptive to the normal operation of the retail outlet. NAVSEA audit teams also inventory representative magazines of each retail stock point on an annual basis. The minimum acceptable accuracy for these inventories is ninety-seven percent.

(3) Optical Scanning System. The Optical Scanning System (OPSCAN) is a conventional bar code system that facilitates the obtaining of inventory data. Each weapons station has installed the system which "reads" labels affixed to each pallet of ammunition. Currently, labels are locally prepared. Data is "read" by a wand, then recorded on cassette tape and compared to NOMIS for reconciliation.

OPSCAN is scheduled for replacement by the Fleet Optical Scanning Ammunition Marking System (FOSAMS) which will be directly linked to the new OMS data base to achieve an integrated inventory and management system at the retail level.

III. ANALYSIS OF GUN AMMUNITION MANAGEMENT

A. RESEARCH METHODOLOGY

The process of setting prescribed allowances and operating levels of ammunition at retail stock points is incredibly complex, with strategic analysts determining "level of effort" required to support mobilization contingency plans worldwide. Models and data used to compute the majority of needs (the Non-Nuclear Ordnance Requirements) carry a security classification of Secret. Rather than determining whether or not requirements are properly set, this study focuses on problem areas in meeting established allowance levels in an efficient manner. Specifically, the steps of the research were oriented towards determining how the system is *designed* to operate and comparing this to how the system *actually* operates. Where performance does not match standards, suggestions are made for potential control improvements or areas for cost savings. For simplicity, these are classified into those under the cognizance of the producer organization and those under the cognizance of the consumers.

B. AN ILLUSTRATIVE EXAMPLE

Since there are literally hundreds of line items managed by the Navy under the heading of conventional gun ammunition, data collection and analysis of the aggregate of all of these items was expected to be extremely time-consuming, beyond that available for this thesis. Therefore, two specific line items are selected as representative of the aggregate, and data obtained for these items is used as an illustration to highlight issues.

The items selected for the analysis were propelling charges for the 5"/54 caliber gun system, the most common gun system installed in the fleet today. A propelling charge is used to propel a projectile towards its target, and is basically a metal casing which holds gunpowder and a primer device which initiates the explosive process. The particular items were chosen because one is a substitute for the other, with the older item being phased out of service. The older item is identified by Navy Ammunition Logistics Code (NALC) D324 and the newer by D326.

Both items have identical characteristics with the exception of the plug at the top of the casing which seals the unit after filling with gunpowder. In the D324 configuration, which was introduced into service in the mid-1950s, this plug is made of a cork material; in the D326 configuration, introduced during the mid-1970s, the plug is constructed of a polyurethane material. The reason for this change, and for the development of D326, is that the cork plug was found to compress slightly as it moved through the complicated loading machinery of the 5"/54 caliber gun system. This problem was detected during prolonged gunfire support operations in Vietnam. The propelling charges could conceivably be cycled through the loading system several times before consumption, resulting in a powder case that was sufficiently shortened to cause problems in the intricate interlocks used in the automatic 5"/54 caliber loading system. Multiple cycling through the loading system was common in Vietnam, as the loading drums were normally filled regardless of how many rounds were to be fired. Unused ammunition was then unloaded from the system and returned to the magazine, where it was possible to repeat the process another time. Failure of the interlocks would often interrupt the firing circuit, preventing firing of the gun.

As the D324 is cycled through renovation action, it is normally converted to the D326 configuration by replacing the cork plug with the polyurethane plug. However, rather than forcing renovation or disposing of remaining stocks of the D324, Navy officials estimated that training use of the D324, which was still quite serviceable and reliable for this application, would deplete the inventory in a few years, probably before 1980. Yet, even though no purchases of D324 have been made since 1975, it continues to remain in substantial quantities in the Navy inventory in 1985. Based on recent consumption data, the D324 inventory will not be depleted until 1989 to 1991.

Meanwhile, this aging inventory is accumulating increased costs of inventory maintenance, renovation, and disposal. These are costs the ammunition management organization can ill afford to pay in a climate of budget reductions. While projected requirements call for procurement of approximately 100,000 propelling charges each year, recent purchases have averaged only slightly more than 83,000. This would suggest that the Navy must make better use of its existing resources if the gap between requirements and assets is to be closed. Avoidance of unnecessary renovation costs, while not directly applied to increased purchases in the short run, can make more funds available for additional purchases in the long run.

C. PRODUCER RESOURCE MANAGEMENT

As indicated in Figure 2.1, the producer organization consists of the Naval Sea Systems Command, the Ships Parts Control Center, the Single Manager for Conventional Ammunition, and miscellaneous field activities under the control of the Naval Sea Systems Command, primarily the Naval Weapons Stations. This entire organization is geared towards meeting consumer demands, and it does this remarkably well despite operating under a number of resource constraints.

1. The Naval Sea Systems Command

Recognizing the inventory management problems cited in the D324/D326 discussion, the Naval Sea Systems Command (NAVSEA) has recently implemented the Issue Priority Program by [Ref. 10: p. 1]. The Issue Priority Program presently addresses a small percentage of the assets managed by NAVSEA, with expansion to all 2T cognizance items scheduled for later this year.

As a consequence of improper stock rotation, the current inventory of 2T cognizance ammunition is a mixture of old and new stocks. The older stock has deteriorated over time, decreasing the reliability of the inventory. Thus, in a period of high demand, such as mobilization, consumers may be faced with using these older stocks at a time when they really need the new assets. As shown in Table II, fleet consumption in recent years has been higher for the D326, or preferred, item. This data shows usage as a percentage of propelling charges consumed since actual quantities are classified.

The Issue Priority Program formally sets forth a plan requiring retail activities and inventory managers to issue the older, "less-preferred" items to consumers for use in training scenarios. Training demands are indicated on the requisition by a three-digit usage code. In the D324/D326 example, if a fleet unit requisitions D326 propelling charges from the inventory manager, the retail activity is directed to issue D324 stock instead. Additionally, the retail activity is directed to issue the oldest D324 available in the appropriate condition code. In this manner, NAVSEA intends to systematically purge the inventory of older stock through substitution and issue of older assets.

TABLE II

Propelling Charge Consumption

	Year		
Item	1982	1983	1984
D324 (cork)	40.9	43.0	35.1
D326 (polyurethane)	59.1	57.0	64.9
Total	100.0	100.0	100.0

Note: Figures reflect percentage of propelling charges consumed.

Another area addressed by the Issue Priority Program is that of small or remnant lots. For gun ammunition, each production run is identified by location and date of production. This ammunition is then identified by its Ammunition Lot Number (ALN) throughout its life cycle, thereby allowing users and managers to identify individual projectiles and propelling charges in case of subsequent recall for recertification, renovation, or disposal. Production lots are distributed to retail outlets, issued to fleet units, and expended or returned to the retail activity. Over the course of time, these lots become more and more scattered as ammunition is transferred for a variety of reasons.

The centralized concept of inventory accountability, whereby a single information system provides ammunition tracking for physical security purposes, requires that inventory managers and retail outlets maintain visibility of assets by lot number for all holders of ammunition. Obviously, the administrative cost of maintaining records and quality assurance on many small lots is high. The Issue Priority Program requires that, within a given Navy Ammunition Logistics Code (NALC), the retail outlets issue small lots first whenever possible to reduce these administrative costs.

2. Ships Parts Control Center

a. Control Problems

The Ships Parts Control Center (SPCC), Code 85, is the Navy's Inventory Control Point (ICP) for all ammunition inventory matters. It receives all requisitions for ammunition from the fleet and retail activities, maintains centralized worldwide asset postures, and directs appropriate action for each requisition received. SPCC also distributes all new or renovated assets and controls consolidated renovation programs.

The inventory management branch for conventional gun ammunition is a small group which is kept so busy in reacting to requisition actions, filing reports, and maintaining asset balances that it does not have time to adequately manage inventory. Managing inventory should consist of periodic review of individual weapons station asset postures, scheduled demands, and fleet returns. The inventory manager should review his inventory by condition code and be active in pressing for renovation and inspection action. In addition, he should have time for random checks to make sure that individual weapons stations are complying with the Issue Priority Program. Finally, he should conduct in-depth reviews of individual requisition action.

As an example, a ship may submit its requisition for a specific item to SPCC, indicating the date it desires to visit the retail stock point. Data from the Conventional Ammunition Integrated Management System (CAIMS) indicates that the desired retail stock point has sufficient assets to meet this demand, so the requisition is referred to that stock point for action. If, however, the asset balance is incorrect and insufficient assets are on hand, the retail activity may reject the requisition, forcing the inventory manager to ship in the required assets from another retail activity or from a wholesale stock point. The inventory manager normally has insufficient time or resources to determine why this unnecessary redistribution, at substantial cost, was required. Although managers were unable to specify how often this takes place, they acknowledged that it is not uncommon. Such a problem is the result of inaccuracy in inventory reporting (either by NOMIS or CAIMS), which are both steadily improving in accuracy. At issue is the lack of time available for the managers to follow up on such actions.

Why do retail activities "reject" requisitions they should be able to fill? Why is there a constant shuffling of assets among the retail activities? These types of questions remain unanswered by the inventory managers, because staffing levels do not allow them to actively pursue these problems.

Compliance with the Issue Priority Program will be another problem. Even though users must requisition gun ammunition directly from SPCC, CAIMS automatically refers requisitions to retail stock points. The inventory manager must therefore manually intervene to prevent a ship's requisition for a preferred item (such as D326) from reaching the retail activity. This will be a tremendous problem when the program is fully implemented.

The crucial issue at SPCC is one of control. SPCC, an agency of the Naval Supply Systems Command (NAVSUP), is tasked with management of NAVSEA assets at the retail stock points, which are NAVSEA field activities. In the Navy, a clear chain of command is essential in specifying authority and responsibility at each level. In the ammunition management arena, SPCC has most of the responsibility for an efficient system of providing ammunition, yet has no real authority over the weapons stations, which are NAVSEA activities handling NAVSEA assets. Having no real authority over the weapons stations, SPCC must rely on a system of reports to perform its mission. This organizational peculiarity wastes time and prevents better management of resources.

The control issue is further complicated by the monthly Fairshare Distribution Plan, which inventory managers prepare to distribute new and renovated assets to maintain equitable asset readiness postures among the Fleet Commanders-in-Chief (FLTCINCs). While SPCC determines the amount to be provided to each FLTCINC, the FLTCINC determines the specific retail activity to receive the assets, normally in coordination with SPCC.

b. The Conventional Ammunition Integrated Management System (CAIMS)

The CAIMS data base, maintained at SPCC, provides worldwide asset postures to managers throughout the producer/user system. As shown in Figure 3.1, a variety of inputs is used to update the data base. Considering that every transfer requires at least two reports (issuer and receiver) and that hundreds of transactions occur daily, the opportunities for error are numerous.

CAIMS has an installed error-checking logic, comparing reported asset balances to those in the data base.

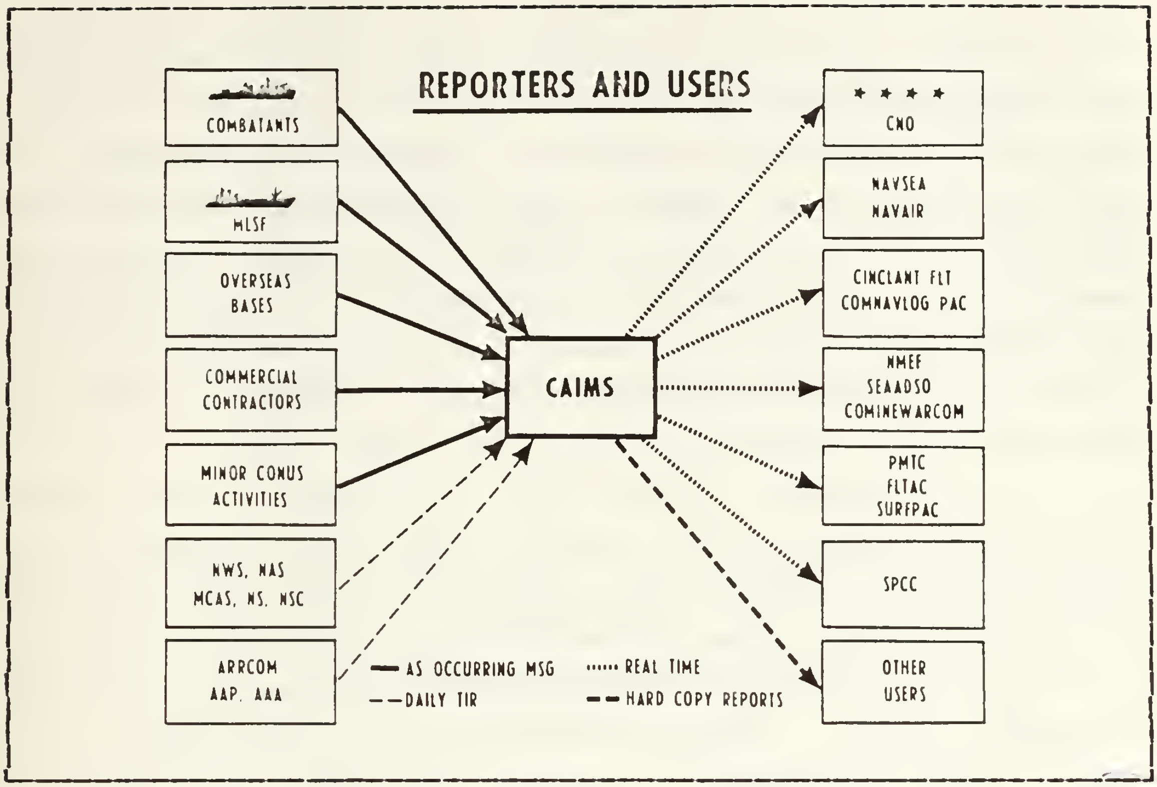


Figure 3.1 CAIMS Reporters and Users.

If an error is detected, it automatically generates and sends a message requiring reconciliation to the reporting activity. CAIMS managers estimate that the rate of error is two to three percent for most reporters and four to six percent for a few. If a timely response is not received to the CAIMS reconciliation request, CAIMS will generate a follow-up message.

For retail activities conducting hundreds of transactions daily, these reconciliations often take several days to accomplish. In the meantime, a follow-up message reconciliation for the same item may be received, snowballing the problem. Since SPCC has no means of enforcement, the retail activities have a tendency to be unresponsive in this area.

While weapons station personnel blame most errors on the automatic data processing system, errors take place generally because of the amount of manual effort required at the retail activity. Issues, receipts, and asset condition code changes must be manually entered into the weapons station's Naval Ordnance Managment Information System (NOMIS). This MIS then generates an output suitable for CAIMS reporting. Unfortunately, the output must then be manually transcribed to punched cards or magnetic tape and forwarded electronically to the CAIMS data base.

Although Figure 3.1 indicates that CAIMS provides real-time data, this is not exactly true. The weapons stations update their NOMIS data base at the close of business daily; transactions are transcribed and reported to CAIMS the next day. Since CAIMS operates in the batch processing mode, these transactions are processed that night. The information is then provided to inventory managers and is at least two days old.

CAIMS managers are aware of these problems and an upgrading of the system is scheduled over the next several years. An integrated system of the Fleet Optical Scanning Ammunition Marking System (FOSAMS), the Ordnance Management System (OMS), plus new CAIMS hardware and software will be installed by 1990. This integration will remove virtually all manual inventory reporting operations and will operate on a real-time basis.

3. Naval Weapons Stations

a. Inventory Requirements

Weapons station inventory requirements are set by the Approved Basic Stock Level of Ammunition (ABSLA), a combined effort of NAVSEA and the FLTCINCs. The ABSLA represents standards that should be reached if asset and funding availability are not constraints. ABSLA achievement depends on current status of assets, storage capabilities, items to be provided via the Fairshare Distribution Plan, and expected offloads of customers. In reality, the ABSLA provides only loose guidelines, with the primary mechanism for control being the FLTCINC inputs to the Fairshare Distribution Plan. Table III indicates the percentage of ABSLA achievement for 5"/54 caliber propelling charges for two weapons stations at two randomly selected points in time.

TABLE III
ABSLA Achievement

	Time A	Time B
Weapons Station X	94.4%	104.8%
Weapons Station Y	87.6%	74.9%

The dynamic nature of ammunition distribution makes setting of absolute inventory figures impractical, and the FLTCINC inputs are probably the most realistic means of prescribing inventory levels.

b. Inventory Management Procedures

(1) Storage Considerations. A magazine storage plan must consider a number of factors including types and quantities of ammunition, storage compatibilities,

sizes and locations of magazines, sensitivity and security requirements, and customer demand rates. Additionally, many magazines are basically buried huts of World War II vintage which are not designed for modern warehousing efficiency. These constraints make any attempt to optimize storage and stock rotation difficult. Manpower shortages and the cost of handling ammunition add to the problem. Average data obtained from weapons stations indicates that the cost to issue one ton of ammunition is $264.57; costs for receiving are $27.47 per ton, and for shifting ammunition from one location to another costs $35.00 per ton. These costs include ammunition handling and associated administrative costs. Considering that a single pallet of 5"/54 caliber propelling charges (thirty-nine charges) weighs almost one ton, the costs involved in maintaining a strict stock rotation plan are significant.

(2) Inventory Accuracy. Maintaining an accurate inventory is a tremendously difficult problem. As has been stated, conventional gun ammunition magazines typically have many aisles of pallets stacked three high. As a result of past shuffling and issuance of partial pallets, individual pallets may contain a mixture of items of different types (different Navy Ammunition Logistics Codes) or may have multiple production lot numbers within a single NALC, or any combination of the two. This information is necessary for accountability purposes.

An ammunition handler may be in Magazine X, drawing items for a scheduled customer, and then proceed to Magazine Y to obtain additional items. What if he notices that Magazine X also has those items he needs from Magazine Y? Will he get them from X instead? Will he really remove several pallets in Magazine X to get at the oldest stock on the bottom, or will he take a pallet which is more accessible? While most handlers will retrieve the proper pallet, a few choose the more convenient alternative and undermine proper stock rotation.

A 1974 report by the Naval Audit Service illustrates the consequences [Ref. 11: pp. 3-8]. The auditors visited a weapons station where a wall-to-wall inventory was in progress. From the selected magazines, all material was removed, the magazines cleaned and marked, and all material was inventoried. One week after the magazines were available for service, the auditors conducted another inventory count. During the intervening week, no issues had been recorded and only a small number of receipts had been stored. They found that:

(1) Quantities on the inventory records did not agree with quantities on hand;

(2) Material was on the inventory records which was not in the magazine;

(3) Material was in the magazine which was not on the inventory records;

(4) Locations shown on the inventory records were inaccurate.

Since 1974, improvements have been made in accuracy, particularly through the Optical Scanning System (OPSCAN) and the Naval Ordnance Management Information System (NOMIS). A complete wall-to-wall inventory was conducted from 1982 to 1984 in all weapons stations to improve accuracy. As was mentioned earlier, Department of Defense guidelines require that local inventory records show a ninety-seven percent accuracy level when compared to actual random checks of inventory. Based upon recent NAVSEA internal audits, the weapons stations are now very close to that figure.

(3) Order Picking. As shown in Appendix B, NOMIS provides retail activity inventory managers with a valuable tool. These managers, located within the

Ammunition Distribution and Control (AD&C) branch, receive requisition referrals from SPCC and are tasked with selecting the assets to be provided to the customer. The AD&C personnel can then compile a list of ammunition to be selected from the various magazines and provide that list to ordnance handling personnel for breakout.

Using NOMIS, which has been installed for several years, these AD&C managers should be able to locate the oldest stock and select that for issue while minimizing the picker's travels. As evidenced by the motivation for the recent Issue Prioriy Program, this has not happened and the inventory continues to be burdened with old stock. Contributing factors at this level are suspected to be lack of understanding on the part of AD&C managers and lack of control of personnel performing the actual order picking. Additionally, funding and manpower constraints are a factor in that local budgets may prohibit the extra time required in digging out the older stock, causing AD&C managers to minimize breakout time at the expense of proper stock rotation.

(4) Segregation Program. Any ammunition turned in to a retail activity from a fleet unit is automatically reclassified to condition code K and set aside for inspection. This is a common occurrence, since ships are required to offload all ammunition prior to entering overhaul or prolonged maintenance availability, and ships returning from deployment often turn in excess materials. Since this ammunition may have been onboard the ship for as long as three years, an inspection to determine continued serviceability is considered prudent.

CAIMS data obtained for random dates discloses that approximately fifteen percent of all 5"/54 caliber propelling charges held at retail outlets is in condition code K at any one time. This represents inventory that is merely awaiting inspection, after which it is reclassified depending on condition. Although NAVSEA requires that segregated ammunition be inspected within thirty days, it is generally acknowledged that this does not always happen.

The major factor creating this backlog is again a lack of funding for manpower. Personnel in the quality assurance division are simply unable to keep up with demand. A weapons station may experience such a large backlog that it requests shipment to the Single Manager for Conventional Ammunition (SMCA) for inspection. Typically, this occurs infrequently due to the extra costs involved.

Finally, handling this ammunition is particularly expensive because it is initially stored, retrieved for inspection, reclassified, and stored again.

4. System Problems

a. Redistribution

Redistribution of assets normally occurs between retail outlets when one outlet is unable to meet a customer demand or, less often, when directed as part of the Fairshare Distribution Plan. Ammunition is constantly being shuffled among the weapons stations on each coast. Due to Interstate Commerce Commission regulations, this material is transported normally by contracted common carriers who are able to meet strict safety and security requirements. As shown in Table IV, costs are not significantly different for a truckload or less than truckload.

Although some amount of redistribution is to be expected, SPCC inventory managers generally acknowledge that the system is abused. Usually, managers are reacting to a short notice requirement which prevents consolidation into full truckload shipments. Certainly a substantial amount

TABLE IV

Ammunition Shipping Costs

Weight	Cost per Shipment
Truckload (40,000 pounds)	$550
Less than Truckload (5-10,000 pounds)	$520
Less than Truckload (1-5,000 pounds)	$480
Less than Truckload (under 1,000 pounds)	$445

could be saved if inventory managers had more time to analyze stock positions and plan consolidated shipments rather than reacting to piecemeal requirements. No mechanism is in place to determine the validity of individual redistribution shipments.

Redistribution also generates additional expenses for record keeping in updating inventory files, ammunition handling, and document preparation. Better planning and management of retail assets can be expected to save substantial funds and reduce workloads in this area.

b. Renovation

Rotation of stock can help reduce the amount of materials requiring recertification and subsequent renovation. As has been indicated, this has not happened in the past and unnecessary costs have been incurred.

In 1983 and 1984, NAVSEA spent $12 million (plus shipping) for renovation, and will spend $9 million in 1985;

almost $2 million was spent in 1983 for 5"/54 caliber propelling charges alone. While the vast majority of this expense is justifiable and necessary, cost savings can be realized with a working stock rotation policy.

Items held at retail stock points awaiting renovation (condition codes E and F) are either repaired locally or sent to one particular outlet for consolidation. Consolidation achieves benefits of learning curves and economy in set-up costs, which is compared on a case-by-case basis to costs of shipping and manpower availability at the retail activities involved. This program is carefully managed by NAVSEA through distribution of NALC Renovation Sequence Plans to all retail outlets.

c. Disposal

There is currently a backlog of 34,000 short tons of ammunition materials awaiting disposal worldwide [Ref. 12: p. 6], including 38,500 line items. These are extremely significant numbers because materials awaiting disposal or demilitarization must be afforded the same stock visibility as serviceable ammunition. These assets are generating enormous costs in occupying magazine space, inventory administration, and security requirements.

Unfortunately, when budget cuts occur, disposal operations are the primary choice to eliminate. At the NAVSEA level, managers would rather cut disposal than procurement. At the weapons station level, disposal operations are cut rather than reducing direct customer support.

Each weapons station has some degree of disposal capability. It is common practice to operate these plants on a "level loading" basis; that is, manpower is devoted to the plant when it can be spared from direct customer support. This results in idle plant time while materials are awaiting disposal. In one instance, a station shut down its disposal plant due to budget cuts, then had to construct a temporary magazine to hold overflow ammunition. This temporary magazine would not have been needed had the disposable assets been removed.

An additional consideration is that disposal operations often generate "income" from components which are reclaimed in the demilitarization process. Components such as fuzes are often returned to the Single Manager to be used in new production runs, resulting in a cost savings to the Navy.

d. Condition Code Management

Table V, retrieved from CAIMS data, indicates a breakdown of 5"/54 caliber propelling charges (NALC D324 and D326) by condition code as a percentage of total assets.

This data, taken approximately four months apart, shows that only seventy-six percent (condition codes A and B) of all assets held at the retail outlets is available for issue. Through improved stock rotation and more timely inspection of condition code K assets, this figure can be substantially improved.

D. USER RESOURCE MANAGEMENT

The Navy expends over $350 million annually for munitions, with approximately $50 million spent on conventional gun ammunition [Ref. 13: p. 1]. There is substantial evidence to suggest that the customer does not carefully manage his ammunition. In fact, many of the problems cited as producer problems are derived from an intense desire to meet customer demand, often without careful consideration of efficiency.

TABLE V

Condition Code Analysis

Item	Condition Code						
Time A	A	B	E	F	K	P	Other
D324	68	2	2	11	17	0	0
D326	67	11	0	9	13	0	0
Total	67	9	1	9	14	0	0
Time B	A	B	E	F	K	P	Other
D324	65	2	3	4	18	7	1
D326	73	8	3	1	13	0	2
Total	70	6	3	2	15	2	2

Notes:
(1) Numbers reflect percentage of total assets.
(2) Only codes A and B are issuable.
(3) Codes E and F are awaiting renovation.
(4) Code K is awaiting inspection.
(5) Code P is awaiting disposal.
(6) Code definitions are in Appendix A.

1. Fleet Commanders-in-Chief

The Fleet Commanders-in-Chief (FLTCINCs) submit annual Non-Combat Expenditure Requirements (NCER) for ammunition and are tasked with managing fleet resources. Via the Fairshare Distribution Plan, they make inputs regarding the staging of these assets. Finally, FLTCINCs allocate annual allowances to individual fleet units.

A 1983 audit by the Department of Defense Inspector General found that many FLTCINC procedures are contrary to effective management of ammunition [Ref. 13: pp. 3-9]. Rather than base the NCER on actual training needs, the NCER is generally based solely on historical allocations. Then, allocations are distributed to ships without regard to operating schedules; the audit pointed out that ships in overhaul were receiving allowances similar to deployable ships. In addition, consumption was not monitored by individual units, but only fleet-wide. Several audited ships expended over two hundred percent of their allowances without question by the FLTCINC.

Individual FLTCINCs can become more active in support of the Issue Priority Program. While no one would suggest sending a deploying ship out with less than the newest, or preferred, ammunition onboard, a number of evolutions in the training arena would be easily satisfied by using older, but still serviceable, stock. Training evolutions such as Refresher Training and Naval Gunfire Support consume significant quantities of ammunition, yet there is no specific guidance to the fleet to request condition code B materials or substitutable (non-preferred) items for these exercises.

2. Fleet Units

Fleet units, primarily ships, have little incentive for supporting proper stock rotation and management of ammunition assets. Fleet ordnance personnel naturally want the best ammunition onboard, as indicated on their Ammunition Allowance List. By submitting a requisition with the Advice Code "2B" which means "no substitutes acceptable", they immediately defeat the intent of the Issue Priority Program. This is justified, of course, for a unit about to deploy; for a ship preparing for a training exercise it is a waste of preferred assets.

From a fleet perspective, this action is understandable. In a peacetime environment, ships are evaluated by their performance in training evolutions. Therefore, commanding officers and ordnance personnel will not want to accept older or mixed production lot ammunition, since even slight irregularities may reduce impact accuracy and adversely affect resulting evaluations.

Finally, fleet units do not view ammunition as a scarce resource. [Ref. 13: pp. 4-8] indicates that from twelve to seventy percent of the gun ammunition expended is used merely to exercise the guns, often without a specific target. A ship that fires ten rounds for practice does not view this as an expenditure of five thousand dollars (which is the approximate cost). Since resupply is readily available (at no cost to the ship) and no one monitors individual ship expenditure, there is no incentive to use ammunition efficiently.

IV. SUMMARY AND RECOMMENDATIONS

A. SUMMARY

It has been previously stated that management of conventional ammunition involves harnessing a very dynamic process with countless opportunities for mistakes. In Chapter II, the basic organization for the management of conventional gun ammunition was discussed, including major programs and procedures designed to accomplish this mission efficiently. In Chapter III, the various parts of this organization were examined to determine how they actually operate. Where the operation deviated from established procedure, alternatives were investigated for improving the major areas of concern. The recommendations presented below are the results of those investigations and, if implemented, should result in cost savings.

B. RECOMMENDATIONS

Management of the Navy's conventional gun ammunition is a dynamic process. At any instant in time the following forces are at work: purchases; issues; condition code reclassification; fleet returns; renovation; disposal; consumption; and redistribution. Until a real-time integrated management information system is installed at all levels, additional resources will be required at key points to achieve cost savings. It is suggested that application of resources in the following areas will be more than offset by savings realized.

1. Naval Sea Systems Command (NAVSEA)

NAVSEA is striving to make the system more efficient through integration of the Conventional Ammunition Integrated Management System (CAIMS), the Ordnance Management System (OMS), and the Fleet Optical Scanning Ammunition Marking System (FOSAMS). Until such time as this system is operational, NAVSEA should complete implementation of the Issue Priority Program for all line items and install controls to make sure this is followed. These controls are discussed below.

2. Ships Parts Control Center (SPCC)

Organizationally, NAVSEA needs to provide SPCC with the structural authority necessary to perform the Inventory Manager (IM) function. This is a chain of command issue concerning NAVSEA and NAVSUP which must be addressed. Currently, SPCC performs a support role with no control over the retail activities. When SPCC detects a problem, it either cajoles the retail activity into correcting it or forwards it to NAVSEA, an action it is reluctant to take.

Problems discussed regarding CAIMS are not revelations to CAIMS managers. The system is saturated and CAIMS managers are making preparations for the new upgraded system. Not only will the new system have new hardware with increased capacity, but the system will be integrated with all retail activities and provide real-time data.

Realistically, NOMIS accuracy compared to actual retail inventory is perhaps ninety-six percent; interface accuracy from the retail activities to CAIMS is approximately the same. Therefore, SPCC inventory managers have only ninety-two percent accuracy of the inventory they manage, and this information is at least two days old. This will not change greatly until the integrated system is available. As a result, improved inventory decisions will be obtained basically through extra effort in analyzing stock positions and reviewing individual problems rather than dealing with aggregates. To this end, inventory managers should be freed of as much routine work as possible, an area that consumes too much of their time. Installing even one or two basic clerks in this branch would provide these managers the time to research redistribution requests and requisition rejections from retail outlets.

In the area of control, these managers should perform random checks of issues reported by weapons stations. If a station issues new (preferred) stock when older (non-preferred) stock is available, the inventory manager should be on the telephone to find out why this happened. If NAVSEA grants the managers the authority to put pressure on the stations, results will be favorable. In particular, the inventory managers are central to the success of the Issue Priority Program, but presently have neither the time nor power to enforce it. All recent guidance has further centralized the ammunition requisition approval function, so inventory managers should have some authority to match their current responsibility.

3. Naval Weapons Stations

In general, managers at the retail stock points seem to have extensive ordnance experience but not much logistics experience. Although it has unusual characteristics, ammunition is basically a commodity requiring warehousing, shipping, and inventory management. A system-wide analysis of materials handling at the weapons stations is needed and common modern equipment selected and installed. Also, guidance on assigning inventory storage locations is needed. It is suggested that a dedicated warehousing manager be trained to implement and sustain this new system at each weapons station.

Older, non-preferred items should be made more accessible as time permits. A mass reshuffling of assets, though desirable, is not feasible due to budget constraints. In making pallet issue selections, it must be kept in mind that digging out a buried pallet is not a free choice, costing more manhours and money than selection of an accessible one. Gradually, however, older stock and remnant production lots must be made more accessible and purged through issue.

Stations should adequately support disposal operations. This will assist in purging magazines of unserviceable assets, reduce associated handling costs, and generate income through reclaimed components.

Assets in condition code K should be more aggressively inspected and reclassified. These are assets of undetermined quality that may be readily issuable; in fact, over seventy-five percent are subsequently placed in condition code A or B. If returns were immediately inspected in a transient, accessible magazine, they could possibly be issued to the next customer and provide a more stable overall stocking plan. This might require hiring of an additional quality assurance technician but would also enhance the manageability of the station assets.

4. Consumers

Fleet Commanders-in-Chief (FLTCINCs) can provide additional support to the Issue Priority Program by establishing ammunition requisition guidelines for training evolutions. It should be stressed that non-preferred items are serviceable assets in condition codes A, B, or C. Since the FLTCINCs receive informational copies of requisitions, they can also randomly check to make sure guidelines are being followed. This action would make significant impact on the purging of older stock and remnant production lots.

Additionally, FLTCINCs should use their CAIMS terminals to routinely monitor ammunition consumption of individual ships to make sure allowances are not disregarded.

Fleet units can support stock rotation by submitting requisitions which reflect intended usage for the ammunition. Justification should be provided for requisitions specifying no substitutes; these should be critically reviewed at some level. Training evolutions are the ideal time to support purging of older materials and remnant lots. If the fleet does not support this program, it will not work because the producer organization is strongly oriented towards supporting fleet desires. In addition, fleet users must see ammunition for the expensive commodity it is and reduce needless consumption.

If the Issue Priority Program is followed at all levels of the producer and user organizations, the distribution system should be effectively purged of older materials in two to four years. However, NAVSEA must also establish controls within producer and user organizations to effect a real change.

Training of key personnel in the ammunition arena seems to be lacking at several points:

(1) SPCC inventory managers require training in consolidation of redistribution efforts and in making longer term stock position analysis;

(2) Weapons station Ammunition Distribution and Control (AD&C) managers need training in selecting appropriate stock for issue and need to make sure that the selected materials are in fact issued;

(3) Weapons station ammunition handlers involved in breakout require training in the importance of their support of stock rotation policies;

(4) Fleet commanding officers need to be motivated into viewing ammunition consumption as the use of expensive resources;

(5) Fleet ordnance personnel need better training in requisition preparation, preferably under the cognizance of the ship's own supply department personnel.

5. Areas for Further Research

Continued analysis of the problem is clearly appropriate and recommended in the hope of streamlining the current system until the upgraded management information system can be installed. Specifically, the following topics are recommended:

(1) Translation of the Approved Basic Stock Level of Ammunition (ABSLA) and historical CAIMS data regarding transactions into an operating stock inventory model for a Naval Weapons Station;

(2) Development of improved controls for the SPCC inventory managers with emphasis on implementation of important procedures such as the Issue Priority Program;

(3) Development of a comprehensive training program for SPCC inventory managers, weapons station AD&C personnel, weapons station ammunition handlers, and fleet ordnance personnel to improve the accuracy and efficiency of management controls;

(4) A study of redistribution flows within the management system to achieve better consolidation of shipments and lower transportation costs.

APPENDIX A

AMMUNITION CONDITION CODES

CODE	TITLE	DEFINITION
A	Serviceable (Issue without Qualification)	New, used, repaired or reconditioned material which is serviceable and issuable to all customers without limitation or restriction. Includes material with more than six months shelf life.
B	Serviceable (Issuable with Qualification)	New, used, repaired or reconditioned material which is serviceable and issuable for its intended purpose but which is restricted from issue to specific units, activities or geographical areas by reason of its limited usefulness or short service life expectancy. Includes material with three to six months shelf life remaining.
C	Serviceable (Priority Issue)	Items which are serviceable and issuable to selected customers, but which must be issued before condition A and B to avoid loss as a usable asset. Includes material with less than three months shelf life remaining.

E	Unserviceable (Limited Restoration)	Material which involves only limited expense or effort to restore to serviceable condition.
F	Unserviceable (Repairable)	Economically repairable material which requires repair or overhaul (includes repairable items which are radioactively contaminated).
K	Suspended (Returns)	Material returned from customers or users and awaiting condition classification.
P	Unserviceable (Reclamation)	Material determined to be unserviceable, uneconomically repairable as a result of physical inspection, tear down or engineering decision. Item contains serviceable component or assembly to be reclaimed.

Note: While other condition codes exist, these are the only codes referred to by the research and account for the vast majority of ammunition at any point in time.

APPENDIX B

NAVAL ORDNANCE MANAGEMENT INFORMATION SYSTEM EXAMPLE

```
AACD15R1-P63     M O N T H L Y     A S S E T     B A L A N C E     F R O M     00001     BUSINESS 85031   CURRENT 85032   PAGE 2T   34.

COG NALC FSC  NIIN       P UI UNIT-PRICE  DLT DML  IR CI MC SC    EXPLWT QQ INQXNO  DOT   CGC SL/SA DTINV      NOMENCLATURE
 2T Q334 1320 010133173 A EA      394 00 85028 G  00         C 1 048000 13 R33400    B 11-C  0 00 C2291 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT   Q-ON-HAND  Q-IN-SUSP  Q-RES/QUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLNO
84248 K     UNKNOWN                  W5934                        6                           233
84354 K     UNKNOWN                  W6724                        4                           339

             COND-A      COND-B      COND-C      COND-D      COND-E      COND-F      COND-G      COND-H      COND-J      COND-K
CLOSING          14           0           0           0          46           0          15           0         167          10
             COND-L      COND-M      COND-N      COND-P    QTY-DUE  QTY-RESERVE  QTY-SUSPENSE   LOW-LIMIT  DEMAND-QTY   DEMFREQ
CLOSING           0           0           0           0          0            0             0         568

 2T Q334 1320 010133173 W EA      394 00 85009 G  00         C 1 048000 13 R33400    B 11-C  0 00 C2291 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT   Q-ON-HAND  Q-IN-SUSP  Q-RES/DUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLNO

             COND-A      COND-B      COND-C      COND-D      COND-E      COND-F      COND-G      COND-H      COND-J      COND-K
CLOSING           0           0           0           0           0           0           0           0           0           0
             COND-L      COND-M      COND-N      COND-P    QTY-DUE  QTY-RESERVE  QTY-SUSPENSE   LOW-LIMIT  DEMAND-QTY   DEMFREQ
CLOSING           0           0           0           0          0            0             0         568

 2T Q336 1320 000388784 A EA       30.00 64331 D  00         U                R10700             D 00 A3187 DUMMY PROJECTILE,5 INCH 54 CAL

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT   Q-ON-HAND  Q-IN-SUSP  Q-RES/QUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLNO

             COND-A      COND-B      COND-C      COND-D      COND-E      COND-F      COND-G      COND-H      COND-J      COND-K
CLOSING           0           0           0           0           0           0           0           0           0           0
             COND-L      COND-M      COND-N      COND-P    QTY-QUE  QTY-RESERVE  QTY-SUSPENSE   LOW-LIMIT  DEMAND-QTY   DEMFREQ
CLOSING           0           0           0           0          0            0             0                       3         1

 2T Q338 1320 010239666 A EA      314 00 85031 G  00  D      U 9 518300 11 R30350    A VII   0 00 C4091 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT   Q-ON-HAND  Q-IN-SUSP  Q-RES/QUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLNO
84193 B 8AB CH-82H001-009A      0882 6PC12C16H3                  48
84075 B 8AB CO-80G001-002A      0760 6PC09A01A1    0788          7                           072 84045
85031 B 8AB CRA78H001-066       0878 6PC12A03H1    0686          1                           013 85026
85029 B 8AB CRA80B001-115            6PC12C14H2    0288         48                           072 85026
85029 B 8AB CRA80B001-115            6PC12C17H2    0288         48                               85026
85031 B 8AB CRA80B001-117       0280 6PC12C1201                  1                               85026
85031 B 8AB CRA80B001-117       0280 6PC12C17H1                 19                               85026
85029 B 8AB CRA80E001-132            6PC12C15H2    0588         12                           072 85026
85029 B 8AB CRA80E001-132       0580 6PC12A05J2    0588         48                           072 85026
85029 B 8AB CRA80E001-132       0580 6PC12A05J3    0588         48                           072 85026
85029 B 8AB CRA80E001-135            6PC12C14H1    0588         39                           072 85026
85029 B 8AB CRA80E001-138       0580 6PC12A04J1    0588         48                           072 85026
85029 B 8AB CRA80E001-138       0580 6PC12A04J2    0588         48                           072 85026
85029 B 8AB CRA80F001-145       0680 6PC12A03J3    0688         48                           072 85026
85029 B 8AB CRA80F001-145       0680 6PC12C17H1                  5                               85026
85029 B 8AB CRA80F001-146            6PC12C15H1    0688         48                           072 85026
85031 B 8AB CRA80H001-165       0980 6PC12A01J1    0988         48                           072 85026
85029 B 8AB CRA80H001-165       0980 6PC12A01J2    0988         48                           072 85026
85029 B 8AB CRA80H001-165       0980 6PC12A01J3    0988         48                           072 85026
```

```
AACD15R1-P63     M O N T H L Y    A S S E T    B A L A N C E    F R O M     00D01     BUSINESS 85031  CURRENT 85032  PAGE 2T  345

COG NALC FSC  NIIN      P UI UNIT-PRICE  DLT DML IR CI MC SC   EXPLWT QD INOXNO  DOT  CGC SL/SA DTINV     NOMENCLATURE
 2T 0338 132D D10239666 A EA     314.0D 85031 G  00  D     U 9.518300 11 R3035D    A VII   0 0D C4091 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT  Q-ON-HAND  Q-IN-SUSP  Q-RES/DUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLND
85029 B 8AB CRA80J001-165       0980 6PC12A02J1    D988         48                           072 85026
85029 B 8AB CRA80J0D1-165       0980 6PC12A02J2    0988         48                           D72 85026
85029 B 8AB CRA80J001-165       0980 6PC12A02J3    0988         48                           D72 85026
85029 B 8AB CRA80J001-165       0980 6PC12A03J1    0988         48                           D72 85026
85029 B 8AB CRA80J001-165       0980 6PC12A03J2    0988         48                           072 85026
85025 B 8AB CRA80J001-166       0980 6PC12A03H1    0988          1                           013
85029 B 8AB CRA80J001-166       0980 6PC12C17H3    0988         18                               85026
85031 B 8AB CRA82J001-186       0982 6PC12A03H1    0990         19                           D13 85026
85031 B 8AB CRA82J001-188       0982 6PC12A03H1    0990          5                           D13 85026
85031 B 8AB CRA82JD01-168       0982 6PC12C12D1                  1                               85026
85031 B 8AB CRA82J001-188       0982 6PC12C17H1                 23                               85026
85025 B 8AB CRA82J001-188       0982 6PC12R00H1                  1
85031 B 8AB SU-80BD01-D01A      0280 6PC12A01H1                 10
85029 B 8AB SU-80C001-002A           6PC12C15H2                  1                           D72 85026
85029 B 8AB SU-80C001-002A           6PC12C16H2                 11                           072 85026
85029 B 8AB SU-80G001-007A           6PC12C16H2    0788         34                           D72 85026
85031 B 8AB SU-80GD01-008A           6PC12C16H1    0780         48                           D72 85026
85031 B 8AB SU-80G001-011A      0780 6PC12A01H1                  2
85031 B 8AB SU-80M001-013A      1280 6PC12A03H1    1288          1                           D13 85026
85029 B 8AB SU-80M001-014A      1280 6PC09C13G1                  8                               85026
84102 E EK5 CRA80E001-132       0580 6PC10D21G1                  5
84102 E EK5 CRA80E001-135       0580 6PC10D21G1                 17
85021 E EK5 CRA80E001-139       0580 6PC10B07C2    0588          4                           279
85D29 E EK5 CRA80F001-144            W5782                      43                           017
84046 E EK5 CRA80F001-144       0680 6PC10D22G1                 26
85021 E EK5 CRA80J001-161       0980 6PC10B07C2    0988          1                           279
84046 E EK5 CRA80J001-170       0980 6PC10D22G1                 21
84046 E EK5 CRA82J001-186       0982 6PC10D22G2                 25
84D46 E EK5 CRA82J001-189       0982 6PC10D22G3                 26
84046 E EK5 CRA82J001-192       0982 6PC10D22G2                  1
84046 E EK5 CRA82J001-192       0982 6PC10D22G3                  3
85029 E EK5 GU80L001M-002A           W5782                      56                           D17
83354 * *** DUE -- N0D10432309-115600 6PC12                                           22
85015 A *** RES -- N600365014P166867                                               1,248
85025 * *** DUE -- N60D365022P190000                                               2,000

                COND-A       COND-B       COND-C       COND-D       COND-E       COND-F       COND-G       COND-H       COND-J       COND-K
OPENING              0        1,083            0            0          228            0            0            D            D            D
CLOSING              0        1,083            0            0          228            0            0            0            D            0
                COND-L       COND-M       COND-N       COND-P      QTY-DUE  QTY-RESERVE QTY-SUSPENSE    LOW-LIMIT   DEMAND-QTY      OEMFREQ
OPENING              D            0            0            0        2,022        1,248            0                       219            3
CLOSING              0            0            0            0        2,022        1,248            0                       219            3

   TOTAL Q-RES/NSN   COND A -      1248


 2T D338 1320 010239668 W EA     314.00 84108 G  00  D     U 9.518300 11 R30350    A VII   0 00 C4091 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT  Q-ON-HAND  Q-IN-SUSP  Q-RES/DUE TCC EVT DTINV INSERNO INSOT SFOT BR INDLND
84108 G     CH80M001-004A      T84-5 6PC10B09C1                  3
84108 G     CH80M001-001A      T84-5 6PC10B09C1                 20
```

```
AACD15R1-P63     M O N T H L Y     A S S E T     B A L A N C E     F R O M     00001     BUSINESS 85031  CURRENT 85032  PAGE 2T  348

COG NALC FSC  NIIN       P UI UNIT-PRICE  DLT DML IR CI MC SC   EXPLWT QD INDXNO  DOT  CGC SL/SA DTINV      NOMENCLATURE
 2T D338 1320 010239666 W EA      314.00 84108 G  00  D      U 9 518300 11 R30350    A VII   0 00 C4091 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT   Q-ON-HAND  Q-IN-SUSP  Q-RES/DUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLND
84108 G     CRA78B001-012    T84-5   6PC10B08C3                 10
84108 G     CRA78C001-029    T84-5   6PC10B07C1                 10
84108 G     CRA78D001-038    T84-5   6PC10B07C1                 20
84108 G     CRA78F001-046    T84-5   6PC10B08C3                 20
84108 G     CRA78F001-051    T84-5   6PC10B09C2                 48
84108 G     CRA78G001-061    T84-5   6PC10B10C2                 42
84108 G     CRA78G001-061    T84-5   6PC10B10C3                 48
84108 G     CRA78H001-065    T84-5   6PC10B11C2                 10
84108 G     CRA78H001-072    T84-5   6PC10B11C2                 10
84108 G     CRA78K001-077    T84-5   6PC10B11C2                 10
84108 G     CRA78K001-081    T84-5   6PC10B09C1                  3
84108 G     CRA79B001-104    T84-5   6PC10B09C1                 12
84108 G     CRA80C001-124    T84-5   6PC10B11C3                 22
84108 G     CRA80G001-149    T84-5   6PC10B10C1                  6
84108 G     CRA80G001-151    T84-5   6PC10B11C2                 12
84108 G     CRA80J001-165    T84-5   6PC10B08C1                 12
84108 G     CRA80J001-165    T84-5   6PC10B09C3                  3
84108 G     CRA80J001-167    T84-5   6PC10B10C1                 24
84108 G     CRA80J001-168    T84-5   6PC10B09C3                 20
84108 G     CRA80J001-169    T84-5   6PC10B08C1                 16
84108 G     CRA80J001-169    T84-5   6PC10B09C3                  4
84108 G     CRA80J001-170    T84-5   6PC10B08C1                 20
84108 G     CRA80J001-171    T84-5   6PC10B09C3                 20
84108 G     ER80G001-003A    T84-5   6PC10B08C2                  4
84108 G     ER80G001-004A    T84-5   6PC10B08C2                 44
84108 G     ER80J001-006A    T84-5   6PC10B11C1                 40

              COND-A      COND-B      COND-C      COND-D      COND-E      COND-F      COND-G      COND-H      COND-J      COND-K
CLOSING            0           0           0           0           0           0         513           0           0           0
              COND-L      COND-M      COND-N      COND-P     QTY-DUE  QTY-RESERVE QTY-SUSPENSE   LOW-LIMIT  DEMAND-QTY     DEMFREQ
CLOSING            0           0           0           0           0           0           0

 2T D339 1320 010239665 A EA      277.00 85025 G  00  D      U 9.521500    R29900            0 00 C4296 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT   Q-ON-HAND  Q-IN-SUSP  Q-RES/DUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLND
84296 K     UNKNOWN                  W5818                      24                            277
85025 * *** DUE -- N600365022P196000                                             1,248

              COND-A      COND-B      COND-C      COND-D      COND-E      COND-F      COND-G      COND-H      COND-J      COND-K
CLOSING            0           0           0           0           0           0           0           0           0          24
              COND-L      COND-M      COND-N      COND-P     QTY-DUE  QTY-RESERVE QTY-SUSPENSE   LOW-LIMIT  DEMAND-QTY     DEMFREQ
CLOSING            0           0           0           0       1,248           0           0

 2T D340 1320 010284943 W EA     1085.00 85018 G  00  D      U 6.466900    R30300            0 00 00000 PROJECTILE,5 INCH 54 CALIBER

TRDT  C CDC LOT-NO/SERIAL-NO OVH-M-Y LOCATION      EXDT   Q-ON-HAND  Q-IN-SUSP  Q-RES/DUE TCC EVT DTINV INSERNO INSDT SFDT BR INDLND
85018 B 8BB CRA84C001-001       0384 PC177                       3                            D11
```

LIST OF REFERENCES

1. Naval Sea Systems Command, *Policies and Procedures Concerning Navy Conventional Gun Ammunition Overhaul Cycles, Grand-Lotting and Data Reporting*, NAVSEA Instruction 4855.14, January 1977.

2. Chief of Naval Operations, *Department of the Navy Physical Security Instruction for Sensitive Conventional Arms, Ammunition, and Explosives (AA&E)*, OPNAV Instruction 5530.13, December 1981.

3. Nicol, W. R., "Management of Conventional Ammunition in the Navy," *Deckplate*, November-December 1984.

4. Department of Defense, *Single Manager for Conventional Ammunition*, DOD Instruction 5160.65, November 1981.

5. Ships Parts Control Center, *Supply Management of Ammunition*, SPCC Instruction 8010.12, November 1984.

6. Naval Sea Systems Command, *Policies Concerning Renovation of Ammunition*, NAVSEA Instruction 8014.1, July 1981.

7. Naval Sea Systems Command, *Naval Sea Systems Command Renovation Brief*, document prepared for visitor orientation, October 1984.

8. Naval Sea Systems Command, *Policy for Stratification of Non-Nuclear Ordnance Material under the Technical Management of NAVSEA*, NAVSEA Instruction 4440.13, March 1977.

9. Naval Sea Systems Command, *Demilitarization and Disposal of Excess, Surplus, and Foreign Excess Ammunition, Explosives and other Dangerous Articles (AEDA) and Inert Ordnance Material*, NAVSEA Instruction 4570.1, February 1978.

10. Naval Material Command UNCLASSIFIED Letter CNM 8011 Serial 04331B/4275, Subject: *Ammunition Issue Guidance*, 21 February 1985.

11. Naval Audit Service, *Special Review of Ammunition Recording and Reporting Methodology at Naval Weapons Station, Yorktown, Virginia*, June, 1974.

12. Naval Sea Systems Command, *Naval Sea Systems Command Munitions Disposal Brief*, briefing paper prepared for Congressional Hearings, September 1984.

13. Department of Defense Inspector General, *Peacetime Consumption of Navy Munitions*, June 1983.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93943-5100	2
3.	Defense Logistics Studies Information Exchange U.S. Army Logistics Management Center Fort Lee, Virginia 23801	1
4.	Commander, Naval Sea Systems Command Naval Sea Systems Command Headquarters Code 642 Washington, D.C. 20362	3
5.	Commanding Officer Navy Ships Parts Control Center P.O. Box 2020 Code 85 Mechanicsburg, Pennsylvania 17055	1
6.	Commanding Officer Naval Ammunition Production Engineering Center Code 90 Crane, Indiana 47522	1
7.	Commanding Officer Naval Weapons Station Code 35 Concord, California 94520	1
8.	Assoc. Professor Alan W. McMasters Code 55Mg Naval Postgraduate School Monterey, California 93943-5100	3

199 - 419

214145

Thesis
C756827
c.1

Covert

An analysis of the
Navy Conventional Gun
Ammunition Inventory
Management System.

thesC756827
An analysis of the Navy Conventional Gun
3 2768 000 62783 0
DUDLEY KNOX LIBRARY